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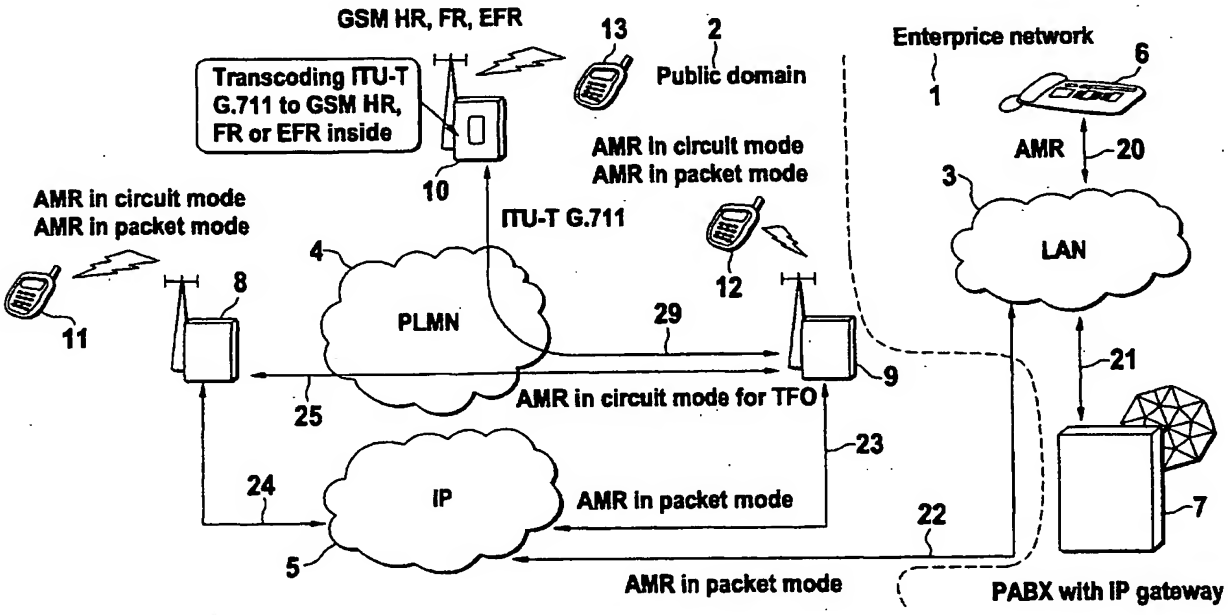
(54) Adaptive bit rate vocoder for IP telecommunications

(57) An adaptive multi-rate vocoder is used for the improvement of a telecommunications between two user equipment while at least one of them is an internet protocol based user equipment. The transmission quality will not only be analyzed when a telecommunications is set up but also during its running. According to that analyze and to the transmission quality required, an encoding level will be chosen. The analyze will be based mostly on the measure of the different latency to which will be subject the digital signals of that telecommunications when being transmitted in packets through at least one IP based network.



EP 1 326 359 A1

[0008] This object is attained by a method of adapting the encoding level of a telecommunications according to the claim 1. Furthermore, it is attained by an user equipment and a second user equipment for performing telecommunications according respectively to the claims 6 and 7. And, it is also attained by a base transceiver station of a mobile radio station according to the claims 8 and 9.

[0009] It is taken advantage of the already existing adaptive multi-rate AMR vocoder as developed for digital cellular telecommunications system in late version of GSM and coming UMTS and as recommended by the 3GPP (third generation partnership project; www.3gpp.org). In the European patent 0755615 is described a method of adapting the air interface in a cellular mobile radio system and corresponding base transceiver station using an AMR vocoder. It shall permit to minimize the occupancy of transmission channels by reducing the quantity of resource allocated to a call on average and by limiting interference induced by a call in neighboring cells. The selection of the encoding level in the used vocoder either on the base transceiver station or on the mobile radio station (wireless phone) of that cellular mobile radio system will be performed after analyzing the transmission quality between both. This is expressed for such typical radio transmission by a measure of the signal to interference ratio which may change quite abruptly during a running telecommunications e.g. when the mobile radio station moves from one cell to the other. Some information representative of that ratio is then compared with at least one predetermined threshold while a same number of threshold is defined as the number of different encoding level was provided. Differently then in the GSM standard where a transmission mode (encoding level) is chosen at the time the call is set up and retained throughout the call, in the patent the encoding level may then be modified or not according to the result of that comparison together with other conditions like the required level of quality for this telecommunications in progress.

[0010] In the present invention, such kind of vocoder or other using e.g. AMR wideband speech codec as described in some documentation from the 3GPP e.g. in TS 26.171 will be adapted for the optimization of the encoding of the digital signals of a telecommunications through an IP network. In this context, the vocoder will be provided with several encoding levels e.g. for AMR wideband from 1.75kbps to 23.85kbps while the used encoding level could be changed according to the measured quality of the transmission of the encoded telecommunications. The quality of transmission is here clearly related to the impairments occurring on such networks. These are usually the different latency i.e. delays to which are subjected the digital signals when being transmitted in packets through the networks.

[0011] In such a way, it is possible to optimize the use of the bandwidth for a telecommunications not only at the beginning but also during its running after a modification of transmission quality could be measured. For example, when an overload capacity suddenly occurs on a network through which the packets are transmitted, these packets will be subjected to a stronger delay. In that case, it is worth to decrease the occupied bandwidth by decreasing the used encoding bit rate. The quality of the telecommunications may decrease but will in that way still be guaranteed. If, in a later stage, some capacity load is freed then an higher bit rate may be chosen as encoding level. The present invention allows to optimize the bandwidth needed for a telecommunications through an IP network according to the available capacity and the desired quality of a telecommunications.

[0012] In an embodiment of the present invention, an user equipment like an IP phone including optionally IP video comprises an encoder. Latter will be used for a telecommunications via exchange of digital signals between said user equipment and a second user equipment. At least two different encoding levels, e.g. for AMR wideband 10 different ones will be provided to that encoder. And the chosen encoding level will be taken according to the transmission quality towards said second user equipment.

[0013] In another embodiment of the present invention, a second user equipment for performing telecommunications via exchange of digital signals with a first user equipment like an IP phone comprises an analyzer of transmission quality of the received digital signals. Latter analyzer is used to measure the possible delay like jitter to which said digital signals may be subjected to when being transmitted in packets at least partly through an IP network. The second user equipment will then transmit the result to the first user equipment allowing it to adapt respectively the encoding level of the transmitted telecommunications.

[0014] Alternatively, it is the base transceiver station of a mobile radio station being a second user equipment which comprises an analyzer of transmission quality of the digital signals received from a first user equipment. Latter analyzer is used to measure the possible delay like jitter to which said digital signals may be subjected to when being transmitted in packets at least partly through an IP network. It is then the base transceiver station which will transmit the result of said measure to the first user equipment allowing latter to adapt respectively the encoding level of the transmitted telecommunications.

[0015] In a further embodiment, the base transceiver station comprises an encoder for a telecommunications between a second user equipment being a mobile radio station connected to the base transceiver station and a first user equipment like an IP phone. The encoder is provided with at least two different encoding levels, each level corresponding to a given bit rate. The choice of the encoding level is taken according to the transmission quality towards the first user equipment. For that, the possible delay is measured like jitter to which said digital signal may be subjected to when being transmitted in

another IP phone. Latter IP phone may be directly connected to the LAN 3. In that case, the encoding level will be adapted in dependency of a change of e.g. latency coming from that LAN 3. But the second user equipment could also be an IP phone connected directly to some other LAN external to the firm network 1 while latter LAN is connected to the IP network 5. Then, the delay measured to adapt the encoding level will be a sum of all the latencies introduced by both LAN i.e. the one 3 from the firm network 1 and the other one together with the latency coming from the IP network 5.

[0025] In the context of the present invention, the encoding level chosen for a transmission direction is usually independent of the one chosen in the reverse direction. Indeed, the packets corresponding to digital signals of a telecommunications from a first user equipment to a second user equipment will not necessarily follow the same path and being subjected to same latency as the ones corresponding to the digital signals of that telecommunications in the reverse direction. Furthermore, a change of encoding level due to some improvement or impairment encountered over the transmission shall not be taken in parallel for both transmission directions. It is not absolutely the case that such improvement or impairment of the transmission will apply at the same time in a same level for both transmission directions.

[0026] The possibility to benefit of the advantage from the use of an encoder like the AMR-wideband for a telecommunications via an IP network while an encoding level can be changed during the running of a telecommunications (on the fly) will improve substantially the use of bandwidth. This will enable to optimize the use of the total available bandwidth lowering the cost of a connection through a public domain 2 like shown on the figure.

Claims

1. A method of adapting the encoding level of a telecommunications between at least two user equipment via exchange of digital signals, said method comprising the steps of:

   providing at least one user equipment with at least two encoding levels for said digital signals, each level corresponding to a given bit rate;
   at the time of a call between the two user equipment, performing an analyze of transmission quality for at least one transmission direction;
   selecting one of said encoding levels for said transmission direction
   in accordance with its transmission quality; and

   characterized by, that said user equipment provided with two encoding levels being an internet protocol based equipment and said analyze of transmission quality being based among other on possible delays to which said digital signals may being subjected to.

2. A method according to claim 1, **characterized by**, that a higher bit rate encoding level being selected when transmission quality being improved, or a lower bit rate encoding level being selected when transmission quality being impaired.

3. A method according to claim 1, **characterized by**, that said analyze of transmission quality being performed regularly during a telecommunications, selecting accordingly one of said encoding level at least following some predefined rules.

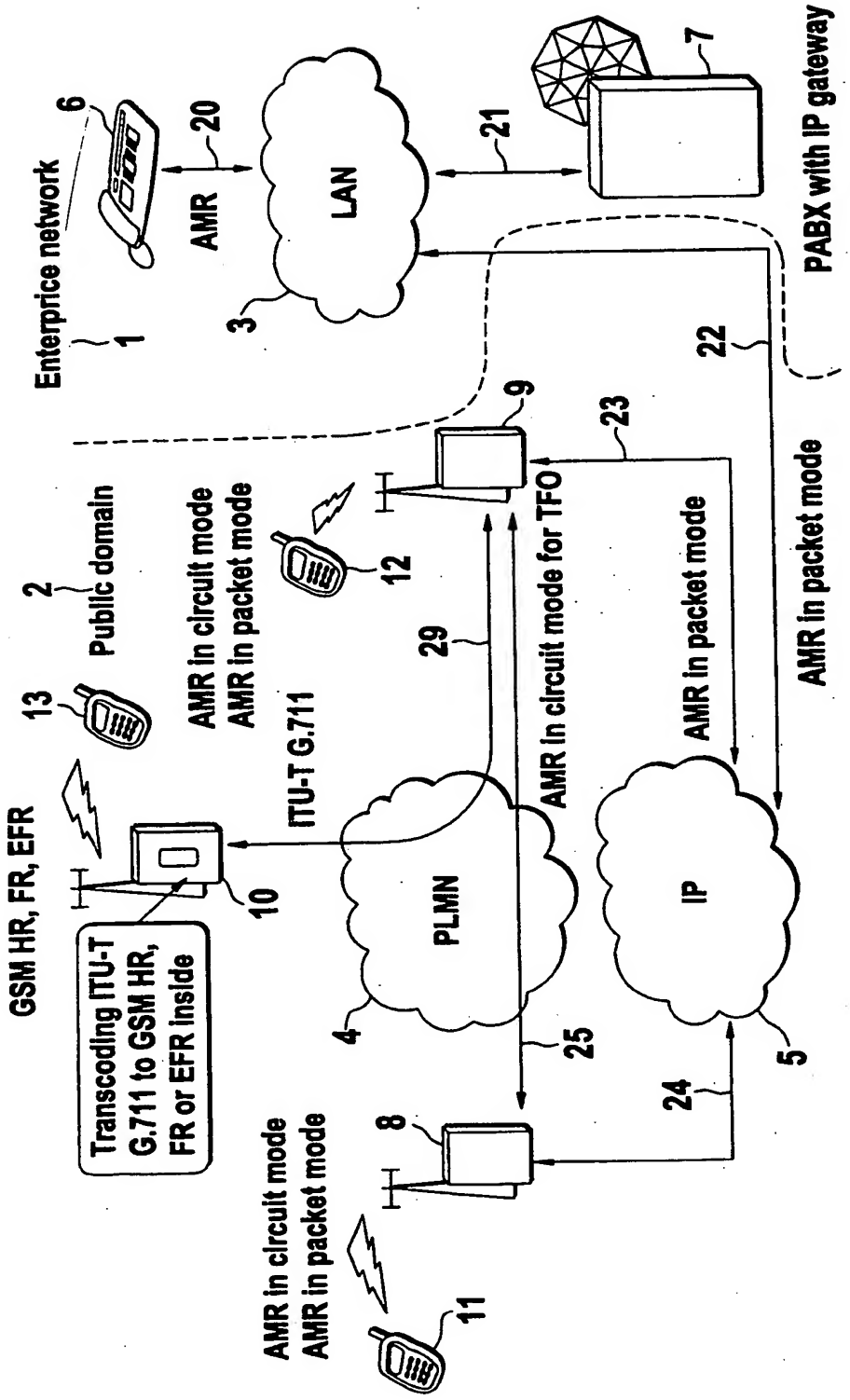
4. A method according to claim 3, **characterized by**, that said rules being defined such to enable to avoid an incessant change of encoding level.

5. A method according to claim 1, **characterized by**, that said delay includes among other typical jitter to which said digital signals may being subjected when being transmitted in packets through a network using internet protocol.

6. An user equipment for performing telecommunications via exchange of digital signals with a second user equipment, said first user equipment comprising an encoder for said digital signals equipped with at least two different encoding levels, each level corresponding to a given bit rate **characterized in, that** said first user equipment being an internet protocol based equipment and the chosen encoding level being taken according to the transmission quality towards said second user equipment based among other on possible delays to which said digital signals may being subjected to.

7. A second user equipment for performing telecommunications via exchange of digital signals with a first user equipment **characterized in, that** said second user equipment comprises an analyzer of transmission quality of the received digital signals while said analyzer being able to measure some possible delay to which said digital signals may be subjected to when being transmitted in packets through a network using internet protocol and said second user equipment being able to transmit the result of said measure to said first user equipment.

8. Base transceiver station of a mobile radio station being a second user equipment for performing telecommunications via exchange of digital signals with a first user equipment **characterized in, that** said base station comprises an analyzer of transmission quality of the digital signals received from said first user equipment while said analyzer being



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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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